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REVISION, CLADISTICS AND BIOGEOGRAPHY OF THE NEOTROPICAL GENUS *SOUZALOPESMYIA* ALBUQUERQUE (DIPTERA: MUSCIDAE)

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Abstract.—*Souzalopesmyia* Albuquerque, a monophyletic Neotropical muscid genus of five species, is reviewed to include two new species, ***Souzalopesmyia paraensis* Carvalho, new species** (Brazil: Pará), and ***Souzalopesmyia sulina* Carvalho, new species** (Paraguay: Canindeyú). Ground plan characters of the Phaoniinae as outgroup were used in a cladistic analysis of the genus. The phylogenetic relationships found are (*S. amazonica* (*S. paraensis* (*S. singularis, S. sulina*)) (*S. carioca*)) and these seem to support at least two biogeographical hypotheses: 1, The basal clade, *S. amazonica,* suggests a date of origin for the genus as far back as the Late Cretaceous; 2, The occurrence of *S. paraensis* in Belém, along south side of the Amazon River, suggests a single dispersal event to colonize that region, in a more recent time, which belongs to the northwestern track.

Resumo.—*Souzalopesmyia* Albuquerque, um gênero monofilético de Muscidae Neotropical com três espécies é revisto para incluir duas novas espécies, ***Souzalopesmyia paraensis* Carvalho** (Brasil: Pará) e ***Souzalopesmyia sulina* Carvalho,** (Paraguay: Canindeyú). Para a análise cladística do gênero, foram utilizados, como grupo de fora, os caracteres do plano básico de Phaoniinae. A partir do relacionamento filogenético encontrado (*S. amazonica* (*S. paraensis* (*S. singularis, S. sulina*)) (*S. carioca*)) podem ser retiradas, no mínimo, duas hipóteses biogeográficas: 1. O clado basal, *S. amazonica,* sugere a data de origem do gênero para o Cretáceo Superior; 2. A ocorrência de *S. paraensis* em Belém, ao sul do Rio Amazonas, sugere que um único evento de dispersão ocorreu para colonizar esta região, em uma época mais recente.

Key Words: Cladistics, biogeography, phylogenetic analysis, *Souzalopesmyia,* taxonomy

Souzalopesmyia Albuquerque 1951 is an unusual genus of rare Neotropical Muscidae because all of its species are yellow. In general, yellow species are inhabitants of very dark shaded habitats. The genus was proposed by Albuquerque (1951: 53) to accommodate two new species, *S. carioca* and S. *amazonica.* Subsequently, Pont (1972) included *Mydaea singularis* Stein 1911, in the genus.

The relationship of *Souzalopesmyia* with other genera of Muscidae is confusing. Malloch (1929) described *Peruvia* (a preoccupied name, now a synonym of *Souzalopesmyia*) to include only *Mydaea singularis* Stein, and considered it to be close to *Charadrella* Wulp 1896 (Cyrtoneurininae). Séguy (1937) synonymized *Peruvia* with *Mydaea* Robineau-Desvoidy 1830 (Mydaeinae), and Albuquerque (1951) considered *Souzalopesmyia* to be close to *Oramydaea* Snyder, the latter being an Afrotropical ge-

nus of Mydaeinae now synonymized with *Myospila* Rondani 1856. Hennig (1965), after examination of the ovipositor of the type species of *Peruvia* put it close to *Helina* Robineau-Desvoidy (Phaoniinae). Carvalho (1989d) included *Souzalopesmyia* in his cladistic analysis of Muscidae and considered it as genus of Phaoniinae (Pont 1972, Carvalho et al. 1993).

The present paper adds two new species to *Souzalopesmyia,* presents a cladogram of the genus, and reflects upon the biogeographic relationships among the included species.

Material and Methods

Specimens from the following institutions were studied for comparative purposes: Department of Zoology, Universidade Federal do Paraná (DZUP), Curitiba, Brazil; Museu Paraense Emílio Goeldi (MPEG), Belém, Brazil; Museu Nacional do Rio de Janeiro (MNRJ), Rio de Janeiro, Brazil; Staatliches Museum für Tierkunde (SMT), Dresden, Germany; Museo Nacional de Historia Natural (MNPA), Asuncion, Paraguay.

The terminology and abbreviations used here are those in McAlpine (1981) and Carvalho (1989a), and the descriptions of the type-specimen labels follows O'Hara (1982).

The sister group of *Souzalopesmyia* is unknown although the genus is considered as one of the most basal members of the tribe Phaoniini (Pont and Carvalho 1997). The sister group may be found in Afrotropical Phaoniini (Pont 1980), which is composed of three genera. Two of these genera, *Phaonia* Robineau-Desvoidy, 1830 and *Helina,* are true but paraphyletic genera of Phaoniini (Hennig 1965). On the other hand, the sister group may be found in a more basal group of Neotropical Muscidae. Character polarities for the genus were based on the ground plan of Phaoniinae, and the assignment by Pont (1986) since no phylogenetic analysis for these genera is available (Huckett and Vockeroth 1987, Carvalho 1989d).

Table 1. Character state distribution among species of *Souzalopesmyia.* 0 = plesiomorphic character states; 1 = apomorphic character states; ? = missing data. Taxonomically useful characters for the species of *Souzalopesmyia.* Characters with an * were used in phylogenetic analysis.

outgroup	000 000 000 000 00
S. amazonica	000 100 010 101 11
S. carioca	101 001 111 101 11
S. paraensis	000 011 110 001 11
S. singularis	000 011 100 111 11
S. sulina	?10 011 100 111 11

*1. Number of frontal setae in female: 0) three; 1) two.
2. Frontal setae in male: 2) two cruciate; 1) two, the lower cruciate, the upper reclinate.
3. Vti: 0) parallel; 1) divergent.
4. Postocular setae row in male: 0) complete and distinct, whole row of setulae reaching epistome; 1) incomplete, row of setulae reaching only to basal half of eyes.
*5. Postocular setae row in male: 0) whole row of setulae black; 1) composed of black and yellow setulae; latter beginning after basal half of eye and reaching epistome, but 1–2 with black setulae.
*6. Number of Dc prst: 0) two; 1) one.
*7. Acr female prst: 0) distinct from the ground setulae; 1) not distinct from the ground setulae.
*8. Proepisternal seta: 0) strong, similar in length to the upper anepisternal setae; 1) weak, less than the length of upper anepisternal.
9. Crossvein dm-cu: 0) almost straight (Albuquerque 1951: Fig. 11); 1) weakly curved (Albuquerque 1951: Fig. 13).
*10. Fifth sternite shape: 0) without sharp depression on posterior side (Fig. 1); 1) with sharp depression on posterior side (Figs. 2, 3, and Albuquerque 1951: Figs. 10 and 12).
*11. Cercal plate: 0) round outline (Fig. 4, and Albuquerque 1951: Fig. 4); 1) squared outline (Figs. 5, 6).
12. Head appearance: 0) not elongate; 1) elongate (Albuquerque 1951: Fig. 1).
13. Number of ocellar setae; 0) two; 1) none.
14. General ground color of the flies: 0) not yellow; 1) yellow.

Table 1 includes all useful characters and character states distribution of *Souzalopesmyia* species and their polarities used in the present paper. The program Hennig86, version 1. 5 (Farris 1988) was used for the phylogenetic analysis, applying the implicit enumeration (ie*) option. Consistency (CI)

and retention (RI) indices were calculated excluding uninformative characters (autapomorphies and synapomorphies of the genus).

Taxonomy

Souzalopesmyia Albuquerque 1951

Peruvia Malloch 1929:104 (preocc. Scudder 1890). Type-species, *Mydaea singularis* Stein, 1911 (orig. desig.).

Souzalopesmyia Albuquerque 1951:53. Type-species, *Souzalopesmyia carioca* Albuquerque, 1951 (orig. desig.).

Diagnosis.—*Souzalopesmyia* may be recognized by its typical head and antenna shape, by the setulose parafacials for half their length, and by the absence of ocellar setae. Also, they are wholly yellow flies except for the presence of stripes on the abdomen (Albuquerque 1951: Figs. 3, 16).

Description.—Male head dichoptic (Albuquerque 1951: Fig. 1), narrower than in female. Frons with orbital setae reclinate, and without crossed setae on frontal vitae. Ocellar setae absent. Antenna long, reaching epistome. Arista plumose, longest hairs equal to greatest antennal diameter. Parafacials setulose on upper half. Female proboscis as in Fig 14. Dc 1–2:3. Acr not distinct from ground setulae, except in female of *S. amazonica*. 2 postpronotals. Ia: 1:2. Sa: 1:2, second weak, about half length of first. 2 pa. 2 subequal npl setae. Pra absent. Disc of notopleuron bare. Anepisternum with a short seta in upper anterior corner. Anepimeron, greater ampulla, vallar ridge, and meron bare. Ktps 1:2 (not 1:1:1 as stated by Albuquerque 1951). Metathoracic spiracle small, triangular, with yellow setulae on margin. Prosternum bare. Fore tibia with 1 PD submedian setae. Fore tarsomere 1 with 1 V setae. Mid femur with 1 AD, 1 D, 1 PD and 1 P preapical setae. Mid tibia with 2–4 P median setae: 1 strong V apical setae. Hind tibia without calcar and with 1 AD median setae, 1 D, 1 AD, 1 AV apical setae. Veins bare, except for costa. Vein M_{1+2} curved slightly toward vein R_{4+5}. Lower calypter of *Phaonia*-type. Sternite 1 bare. Male aedeagus as in Figs. 10–12. Ovipositor long, tergites, sternites and membranes covered with microtrichia (Figs. 15, 16). Three elongate spermathecae. Egg: *Phaonia*-type.

Monophyly.—*Souzalopesmyia* Albuquerque is a monophyletic genus based on the following synapomorphies: 1, Head lateral appearance elongate; 2, Ocellar setae absent; 3, Ground colour yellow.

Remarks.—The species of *Souzalopesmyia* are rare and have similar facies. Based on current collection records, they are found in rainforest habitats. They may be nocturnal, as they are rarely collected by day.

Key to Species of *Souzalopesmyia*

1 Vti divergent. Crossvein dm-cu oblique, weakly curved (Albuquerque 1951: Fig. 13); female: 2 frontals . . . . . *S. carioca* Albuquerque

– Vti parallel. Crossvein dm-cu oblique, almost straight (Albuquerque 1951: Fig. 11); female: 3 frontals 2

2 (1) Dc 2: 3; male: postocular row of setulae incomplete, not reaching epistome; setulae black; female: some acr prst stronger than the ground setulae . . . . . *S. amazonica* Albuquerque

– Dc 1: 3; male: postocular row of setulae complete; setulae black and yellow, the latter beginning after basal half of eye; female: acr prst undifferentiated from the ground setulae 3

3 1 proepisternal seta weak, about ¾ length of the upper anepisternal setae; male: fifth sternite without sharp depression on posterior side (Fig. 1); cercal plate heart-shaped (Fig. 4) . . . . . *S. paraensis* Carvalho, new species

– 1 proepisternal seta strong, similar to the upper anepisternal setae; male: fifth sternite with sharp depression on posterior side (Figs. 2, 3); cercal plate rounded (Figs. 5, 6) 4

4 (3) Species ranging from 8.0 to 9.0 mm in length; posterior ktps strong, about 2 times the length of the anterior one; male: frontal setae both cruciate; fifth sternite as in Fig. 2; cercal plate as in Fig. 5 . . . . . *S. singularis* (Stein)

– Species ranging from 6.5 to 8.0 mm in length; posterior ktps very strong, about 3

times the length of the anterior one; male: lower frontal setae cruciate, upper reclinate; fifth sternite as in Fig. 3; cercal plate as in Fig. 6 . . . . . *S. sulina* Carvalho, new species

Souzalopesmyia amazonica
Albuquerque 1951

Souzalopesmyia amazonica Albuquerque 1951:56; Pont 1972:23 (Neotropical catalog); Carvalho et al. 1993: 84 (Neotropical catalog).

Diagnosis.—This species is very similar to *S. singularis* but, it can be easily distinguished from the other *Souzalopesmyia* species by dc 2:3 setae.

Description.—Male: *Head:* Frons broad, at narrowest point 0.21 of head width. Eye with only normal pubescence. Fronto-orbital plate, parafacial, face and gena silvery white. Fronto-orbital plate broad, broadening gradually from vertex to lunula; at vertex plate almost equal to diameter of anterior ocellus, at lunula equal to three times anterior ocellus. Frontal vitta broad, parallel to vertex. 2 pairs of strong frontal setae on lower ⅔ of frons, former cruciate and latter reclinate; 1 strong orbital, reclinate and divergent. Ocellar triangle black, reaching to insertion of orbital setae, with some setulae behind posterior ocellar setae. Vti strong and parallel. Postocular row incomplete, reaching as single row just below mid level of eye and composed of black setulae. Gena below lowest eye margin equal to twice diameter of the anterior ocellus. Palpi slender, yellow.

Thorax: Ground color yellow, scutum dusted with whitish-grey. Dc 2:3; 5–6 rows of prst acr setulae; 11–12 rows of post acr setulae. 1 proepisternal weak, about ¾ length of upper anepisternal setae. Posterior ktps strong, about 2.5 times length of anterior one. Scutellum with 1 strong pair of apical and 1 subbasal setae; 1 preapical weak but stronger than ground setulae; disc with setulae descending below strong setae; bare ventrally.

Legs: Yellow. Fore femur with complete rows of AV and D setae; AD row weak and just to apical ⅔. Mid tibia with 3 P setae. Hind tibia with 5 AV setae on apical half (Albuquerque 1951: 57).

Wings: Clear, veins yellow. Membrane entirely covered with microtrichia. Crossvein r-m placed before point where vein R1 enters costa. Crossvein dm-cu oblique, almost straight. Calypters and haltere yellow.

Abdomen: Ground-color yellow; in posterior view; with a narrow black stripe on tergite 1 which is enlarged on tergite 3, 4 and 5 (Albuquerque 1951: Fig. 16). Tergite 4 and 5 with 2 strong apical setae.

Terminalia: See Albuquerque 1951: Fig. 12.

Measurements: Length of body, 7 mm (n = 1). Length of wings, 6 mm (n = 1).

Female: Differs from male as follows: *Head:* Frons at narrowest point 0.27 of head width. Frontal vitta broad, divergent to vertex. 3 pairs of strong frontals, former 2 cruciate. Ocellar triangle black, not reaching to insertion of 3rd pair of frontals. Some acr prst stronger than ground setulae. Crossvein dm-cu oblique, more than in male.

Terminalia: See Albuquerque 1951: Fig. 17, 18.

Measurements: Length of body, 8 mm (n=1). Length of wings, 8 mm (n = 1).

Remarks.—Adults have been collected in the afternoon on flowers and at night.

Type material examined.—Holotype ♂ in MNRJ labelled as follow: "35/Manaus—no centro [in the center of the city]/ à noite [at night]/15.vi.933 [15 June 1933]/Ant. [Antonio] Paes Filho" [hand label]; Souzalopesmyia/amazonica sp.n./30.8.50 [30 August 1950 [examined Albuquerque' date] / D. Albuquerque det." [Albuquerque hand label]; "Holotipo [holotype]" [red label]. Specimen in good condition (Lopes et al. 1997). Right fore tarsi, median and hind legs missing. Segments of the abdomen mounted on slide in Canada balsam.

Other examined material.—Total: 1. BRAZIL. Amazonas: Manaus, Ant. Paes Filho, 26.V.1933 (1 ♀ allotype MNRJ).

Souzalopesmyia carioca
Albuquerque 1951

Souzalopesmyia carioca Albuquerque 1951:53; Pont 1972: 23 (Neotropical catalog); Carvalho et al. 1993: 85 (Neotropical catalog).

Diagnosis.—*S. carioca* is one of the largest *Souzalopesmyia* species and can be distinguished from the other species by the divergent vti. The female has only 2 frontal setae.

Description.—Male: *Head:* Frons broad, at narrowest point 0.24 of head width. Eye with only normal pubescence. Fronto-orbital plate, parafacial, face and gena silvery white. Fronto-orbital plate broad, broadening gradually from vertex to lunula, at vertex plate almost equal to diameter of anterior ocellus, at lunula 3 times diameter of anterior ocellus. Frontal vitta broad, parallel to vertex. 2 pairs of strong cruciate frontals on lower ⅔ of frons; 1 strong orbital reclinate and divergent. Ocellar triangle reaching to insertion of orbital setae. Vti strong, divergent. Postoculars in a complete single row, reaching to epistome and composed of black setulae. Gena below lowest eye margin equal to twice diameter of anterior ocellus. Palpi slender, yellow.

Thorax: Ground-color yellow with scutum dusted with whitish grey. Dc 1:3; 6–7 rows of prst acr setulae; 11–12 rows of post acr setulae. 1 proepisternal seta very weak, about half length of upper anepisternal setae. Posterior ktps strong, about twice length of anterior one. Scutellum with 1 strong pair of apical and 1 subbasal setae; 1 preapical weak but stronger than ground setulae; disc with setulae descending below strong setae; bare ventrally.

Legs: Yellow. Fore femur with a complete row of AV, D and AD setae, latter weakest. Mid femur with 2–3 PV setae in basal half, shorter than femoral depth. Mid tibia with 2–3 P setae. Hind femur with 1 strong preapical AV seta, longer than femoral depth; AD row complete; 1 PD, 1 D, 1 AD preapical setae weaker than AV seta. Hind tibia with 4 AV setae on apical half.

Wings: Clear, veins yellow. Membrane entirely covered with microtrichia. Crossvein r-m placed before point where vein R1 enters costa. Crossvein dm-cu oblique, weakly curved in median part. Calypters and haltere yellow.

Abdomen: Ground-color yellow; tergite 3 and 4 each with blackish markings increasing in size to posterior margin in posterior view; tergite 5 blackish, except hind margin (Albuquerque 1951: Fig. 3). A median black stripe on tergites 3, 4 and 5. Tergite 4 and 5 with 2 strong apical setae.

Terminalia: See Albuquerque 1951: Fig. 4–10.

Measurements: Length of body, 8 mm (n = 1). Length of wings, 8 mm (n = 1).

Female: Differs from male as follows:

Head: Frons at narrowest point 0.27 times maximum head width. Frontal vitta broad, divergent to vertex. 2 pairs of strong frontals, cruciate. Ocellar triangle black, not reaching insertion of 2nd pair of frontals.

Terminalia: See Albuquerque 1951: Fig. 14, 15.

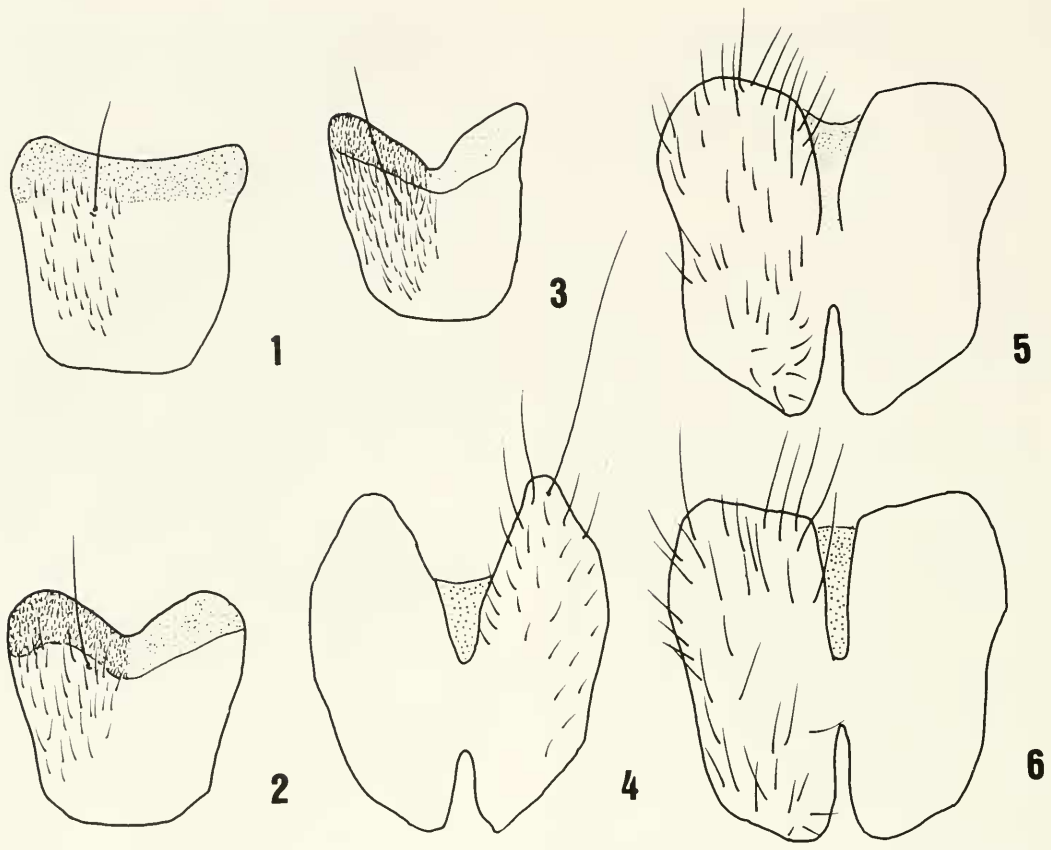
Measurements: Length of body, 8.5 mm (n=1). Length of wings, 8.5 (n = 1).

Type material examined.—Holotype ♂ in MNRJ labelled as follow: "Grajahu/Rio de Janeiro/Lopes [Hugo de Souza Lopes]-6.I.40 [6 January 1940]"; Souzalopesmyia/carioca sp.n./30.8.50 [30 August 1950] [examined Albuquerque date] /D. Albuquerque det." [Albuquerque hand label]; "Holotipo [holotype]" [red label]. Specimen in good condition (Lopes et al. 1997). Right wing on a slide mounted attached of pin holotype. Segments of abdomen on a slide mounted.

Other examined material.—Total: 1. BRAZIL. Rio de Janeiro: Rio de Janeiro, H.S. Lopes, 6.VI.1940 (1 ♀ allotype MNRJ).

Souzalopesmyia paraensis
Carvalho, new species
(Figs. 1, 4, 7, 10, 13, 14, 15)

Diagnosis.—*Souzalopesmyia paraensis* can be distinguished from the other *Souz-*



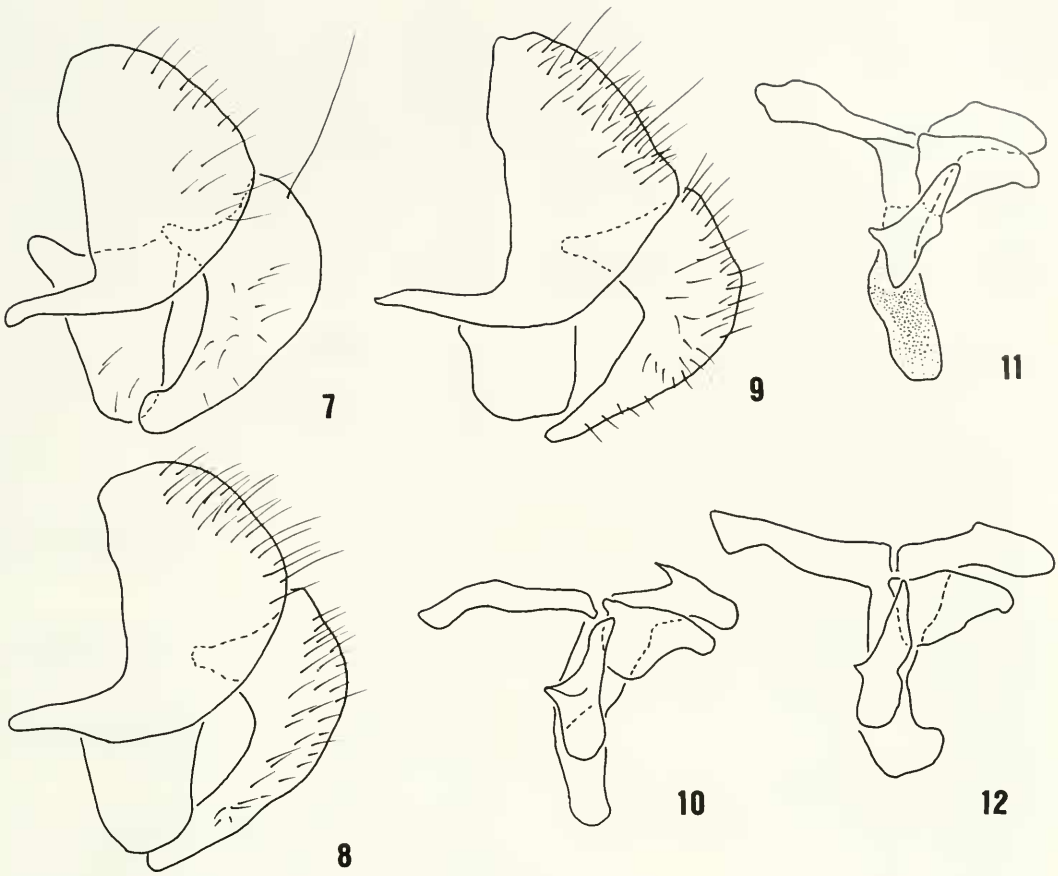
Figs. 1–6. 1–3, Male fifth sternite, dorsal view. 1, *Souzalopesmyia paraensis*. 2, *S. singularis*. 3, *S. sulina*. 4–6, Cercal plate, dorsal view. 4, *S. paraensis*. 5, *S. singularis*. 6, *S. sulina*.

alopesmyia species by male cercal plate rounded in outline and fifth sternite without posterior depression.

Description.—Male: *Head:* Frons broad, at narrowest point 0.21 of head width. Eye with only normal pubescence. Fronto-orbital plate, parafacial, face and gena silvery white. Fronto-orbital plate broad, broadening gradually from vertex to lunula, at vertex plate less than diameter of anterior ocellus, at lunula 3 times diameter of anterior ocellus. Frontal vitta broad, parallel to vertex. 2 pairs of strong cruciate frontal setae on lower ⅔ of frons; 1 strong orbital reclinate. Ocellar triangle reaching insertion of orbital setae. Vti strong, parallel. Postoculars in a complete single row, reaching epistome and composed of black and yellow setulae; latter beginning after basal half of eye and reaching epistome, but 1–2 with black setulae. Gena below lowest eye margin twice diameter of anterior ocellus. Palpi slender, yellow.

Thorax: Ground-color yellow, dusted with whitish grey. Dc 1:3; 7–8 rows of prst acr setulae; 10–11 rows of post acr setulae. 1 proepisternal seta weak, about ¾ length of the upper anepisternal setae. Posterior ktps strong, twice length of anterior one. Scutellum with 1 strong pair of apical and 1 subbasal setae, 1 preapical weak but stronger than ground setulae; disc with setulae descending below strong setae; bare ventrally.

Legs: Yellow. Fore femur with a complete row of AV and D setae; AD row weak. Mid femur with 2 PV setae in basal half, not equal to femoral depth. Mid tibia



Figs. 7–12. 7–9, Epandrium, cercal plate and surstylus, lateral view. 7, *Souzalopesmyia paraensis*. 8, *S. singularis*. 9, *S. sulina*. 10–12, Phallus and associated structures, lateral view. 10, *S. paraensis*. 11, *S. singularis*. 12, *S. sulina*.

with 3 P setae. Hind femur with 1 strong preapical AV seta, longer than femoral depth; AD row complete; 1 PD, 1 D, 1 AD preapical seta weaker than AV seta. Hind tibia with 4 AV setae on apical half.

Wings: Clear, veins brownish. Membrane entirely covered with microtrichia. Crossvein r-m placed before point where vein R1 enters costa. Crossvein dm-cu oblique, almost straight. Calypters and haltere yellow.

Abdomen: Ground-color yellow; in posterior view with a narrow, slight, black stripe on tergite 1 which is blackish and enlarged on tergites 3, 4 and 5. Tergite 4 and 5 with 2 strong apical setae.

Terminalia: See Figs. 1, 4, 7, 10, 13.

Measurements: Length of body, 8.5 mm (n = 1). Length of wings, 6.6 (n = 1).

Female: Differs from male as follows: *Head:* Frons at narrowest point 0.31 of head width. Frontal vitta broad, divergent to vertex. 3 pairs of strong frontals, first one cruciate, second one reclinate and convergent and third one reclinate and divergent. Ocellar triangle black, not reaching insertion of 3rd pair of frontals. Postoculars in a complete single row, with black setulae.

Measurements: Length of body, 8.5–9.0 mm (n = 2). Length of wings, 7.0–7.7 mm (n = 2).

Type material examined.—Holotype ♂ in MPEG, labelled as follow: "Belém Mo-

cambo/ 01-IV-1977"; "Brasil Pará/A.Y. Harada."

Other examined material.—Total: 2 paratypes: BRASIL. Pará: Belém. A. Y. Harada, 1.IV.1977 (1 ♀ DZUP); ibidem, same collector, 6.IV.1977 (1 ♀ MPEG). Specimen in reasonable condition. Left fore and right mid legs missing; left mid tarsi and hind right leg glued on to a card attached to the pin.

Souzalopesmyia singularis (Stein 1911)
(Figs. 2, 5, 8, 11, 16)

Mydaea singularis Stein 1911:91; Stein 1919: 124 (world catalog); Séguy 1937: 282 (world catalog).

Peruvia singularis; Malloch 1929: 105 (type species of *Peruvia*); Hennig 1965: Fig. 31 (tip of female ovipositor).

Souzalopesmyia singularis; Pont 1972: 24 (Neotropical catalog); Carvalho et al. 1993: 85 (Neotropical catalog).

Diagnosis.—*Souzalopesmyia singularis* can be distinguished from the other *Souzalopesmyia* species by posterior depression on male fifth sternite and 2 cruciate frontal setae.

Description.—Male: *Head:* Frons broad, at narrowest point 0.23 of head width. Eye with only normal pubescence. Fronto-orbital plate, parafacial, face and gena silvery white. Fronto-orbital plate broad, broadening gradually from vertex to lunula, at vertex plate less than diameter of anterior ocellus, at lunula 2.5 times diameter of anterior ocellus. Frontal vitta broad, parallel to vertex. 2 pairs of strong cruciate frontals on lower ⅔ of frons; 1 strong orbital reclinate. Ocellar triangle reaching insertion of orbital setae. Vti strong parallel. Postoculars in a complete single row, reaching epistome and composed of black and yellow setulae; latter beginning after basal half of eye and reaching epistome, but 1–2 with black setulae. Gena below lowest eve margin equal to 2.5 times diameter of the anterior ocellus. Palpi slender, yellow.

Thorax: Ground-color yellow with scutum dusted with whitish-grey. Dc 1:3; 5–6 rows of prst acr setulae; 9–10 rows of post acr setulae. 1 proepisternal seta similar to upper anepisternal setae. Posterior ktps strong, twice length of anterior ones. Scutellum with 1 strong pair of apical and 1 subbasal setae; 1 preapical weak, but stronger than ground setulae; disc with setulae descending below strong setae; bare ventrally.

Legs: Yellow. Fore femur with complete row of AV and D setae; AD row weak. Mid femur with 2 PV setae in basal half, less than femoral depth. Mid tibia with 3 P setae. Hind femur with 1 strong preapical AV seta, longer than femoral depth; AD row complete; 1 PD, 1 D, 1 AD preapical setae weaker than AV seta. Hind tibia with 5 AV setae on apical half.

Wings: Clear, veins brownish. Membrane entirely covered with microtrichia. Crossvein r-m placed just before point where vein R1 enters costa. Crossvein dm-cu oblique, almost straight. Calypters and haltere yellow.

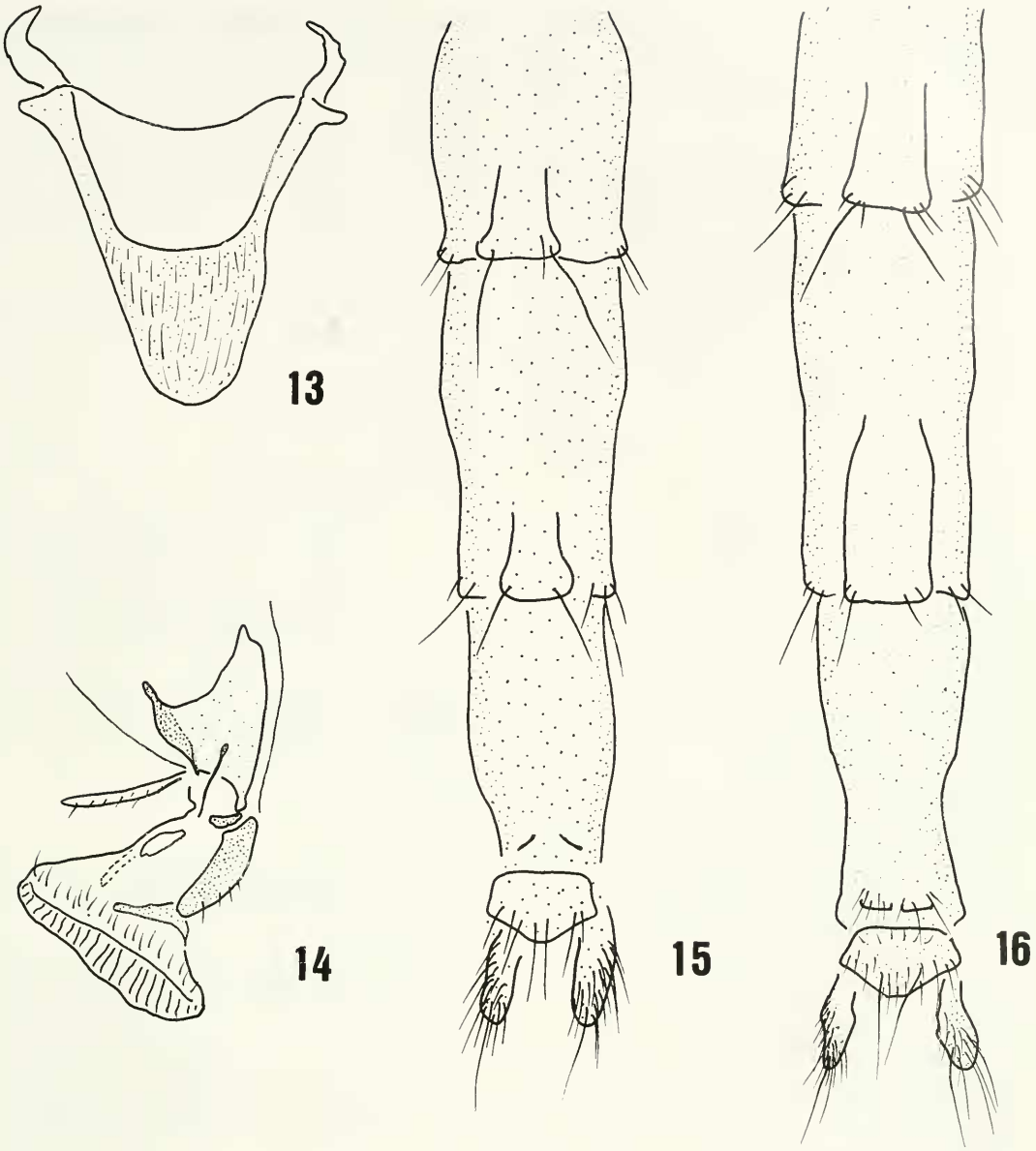
Abdomen: Ground-color yellow; in posterior view with slight narrow black stripe on tergite 1 which is enlarged on tergite 3, 4 and 5. Tergite 4 and 5 with 2 strong apical setae.

Terminalia: See Figs. 2, 5, 8, 11.

Measurements: Length of body, 8 mm (n = 1). Length of wings, 7.5 mm (n = 1).

Female: Differs from the male as follows: *Head:* Frons at narrowest point 0.32 times maximum head width. Frontal vitta broad, divergent to vertex. 3 pairs of strong frontals, first one cruciate, second one reclinate and convergent and third one reclinate and divergent. Ocellar triangle not reaching insertion of 3rd pair of frontals. Postoculars in a complete single row of black setulae.

Measurements: Length of body, 8.5–9.0 (n = 3). Length of wings, 8.0–8. 5 mm (n = 3). Type material examined. Holotype male in SMT labelled as follow: "Bolivia-Mapiri/ 14.III.03 [hand written]/Sarampioni 700 m [green label]": "Coll W. Schnuse/



Figs. 13–16. 13–15, *Souzalopesmyia paraensis*. 13, Hypandrium, dorsal view. 14, Proboscis, lateral view. 15, Ovipositor, ventral view. 16, Ovipositor of *S. singularis*, ventral view.

1911-3"; "Mydaea/singularis/ sp.n. [light green hand written label]: "Typus" [red label]; "Staatl. Museum fur/ Tierlunde Dresden." Specimen in good condition lacking the left hind leg and hind right tarsi. Abdomen in microvial with glycerine.

Other examined material.—Total: 3. BOLIV1A: Mapiri, Sarapioni, 700–800 m, W. Schnuse, III-1903 (2 ♀ SMT); S. Carlos, W. Schnuse, I-1901 (1 ♀ SMT).

Souzalopesmyia sulina Carvalho, new species

(Figs. 3, 6, 9, 12)

Diagnosis.—*Souzalopesmyia sulina* is one of the smallest *Souzalopesmyia* species.

It can be distinguished from the other *Souzalopesmyia* species by deeply posterior depression on male fifth sternite and 2 frontal setae, latter reclinate.

Description.—Male: *Head:* Frons broad. at narrowest point 0.25 of head width. Eye with only normal pubescence. Fronto-orbital plate, parafacial, face and gena silvery white. Fronto-orbital plate broad, broadening gradually from vertex to lunula, at vertex plate about equal to diameter of anterior ocellus, at lunula 2.5 times diameter of anterior ocellus. Frontal vitta broad, parallel to vertex. 2 pairs of strong frontal setae on lower ⅔ of frons; former cruciate and latter reclinate; 1 strong orbital reclinate and divergent. Ocellar triangle black, reaching insertion of orbital setae. Vti strong and parallel. Postoculars in a complete single row, reaching epistome and composed of black and yellow setulae; latter beginning after basal half of eye and reaching epistome, but 1–2 with black setulae. Gena below lowest eye margin twice diameter of anterior ocellus. Palpi slender, yellow.

Thorax: Ground-color yellow with scutum dusted with whitish-grey, more evident in pre sutural area. Dc: 1:3; 5–6 rows of prst acr setulae: 11–12 rows of post acr setulae. 1 proepisternal seta strong, similar to upper anepisternal setae. Posterior ktps very strong, about 3 times length of anterior one. Scutellum with 1 strong pair of apical and 1 subbasal setae; 1 preapical weak but stronger than ground setulae; disc with setulae descending below strong setae; bare ventrally.

Legs: Yellow. Fore femur with complete rows of AV and D setae; AD row weak. Mid femur with 2–3 PV setae in basal half, less than femoral depth. Mid tibia with 3–4 P setae. Hind femur with 1 strong preapical AV seta, longer than femoral depth; AD row weak and complete; 1 PD, 1 D, 1 AD preapical seta weaker than AV seta. Hind tibia with 4–5 AV setae on apical half.

Wings: Clear, veins brownish. Membrane entirely covered with microtrichia, crossvein r-m placed just before point where vein R1 enters costa. Crossvein dm-cu oblique, almost straight. Calypters and haltere yellow.

Abdomen: Ground-color yellow; in posterior view with a narrow black stripe on tergite 1 which is enlarged on tergite 3, 4 and 5. Tergite 4 and 5 with 2 strong apical setae.

Terminalia: See Figs. 3, 6, 9, 12.

Measurements: Length of body, 6.5–8.0 mm (n = 5). Length of wings, 6.5–7.7 mm (n = 5).

Female: Unknown.

Remarks.—Adults have been collected with Malaise traps.

Type material examined.—Holotype ♂ in MHPA labelled as follow; "Depto Canindeyu/Reserva Natural del Bosque/Mbaracayu: Jejui-mi/Malaise 3, bosque bajo inundado/ Colr. A.C.F. Costa/ 10-18.VIV1996 [18 July 1996]"; "Holotipo [holotype]" [red label].

Other material examined.—Total: four paratypes. Same label of the holotype: 2 ♂, 10–18 July 1996 [DZUP, MHPA], 2 ♂, 18–28 July 1996 [DZUP, MHPA].

Discussion

Phylogenetic Analysis

Phylogenetic studies on Muscidae are still scarce (Carvalho 1989d). The family contains about 200 genera with well over 4,000 species worldwide (Pont 1989, Carvalho et al. 1993). The family is undoubtedly monophyletic (Hennig 1965, McAlpine 1989, Michelsen 1991), but historically the Muscidae has included groups that are doubtfully monophyletic (Carvalho 1989d).

Several genera of Phaoniinae in the Neotropics (Pont 1972), a paraphyletic subfamily pointed by Hennig (1965) and recently by Carvalho (1989b), were transferred to other subfamilies (Carvalho 1985, 1989a, 1989b, 1989c, Couri and Lopes 1986, Carvalho & Pont 1998). Currently the subfamily in the region has only four genera (Carvalho et al. 1993): *Dolichophaonia* Carva-

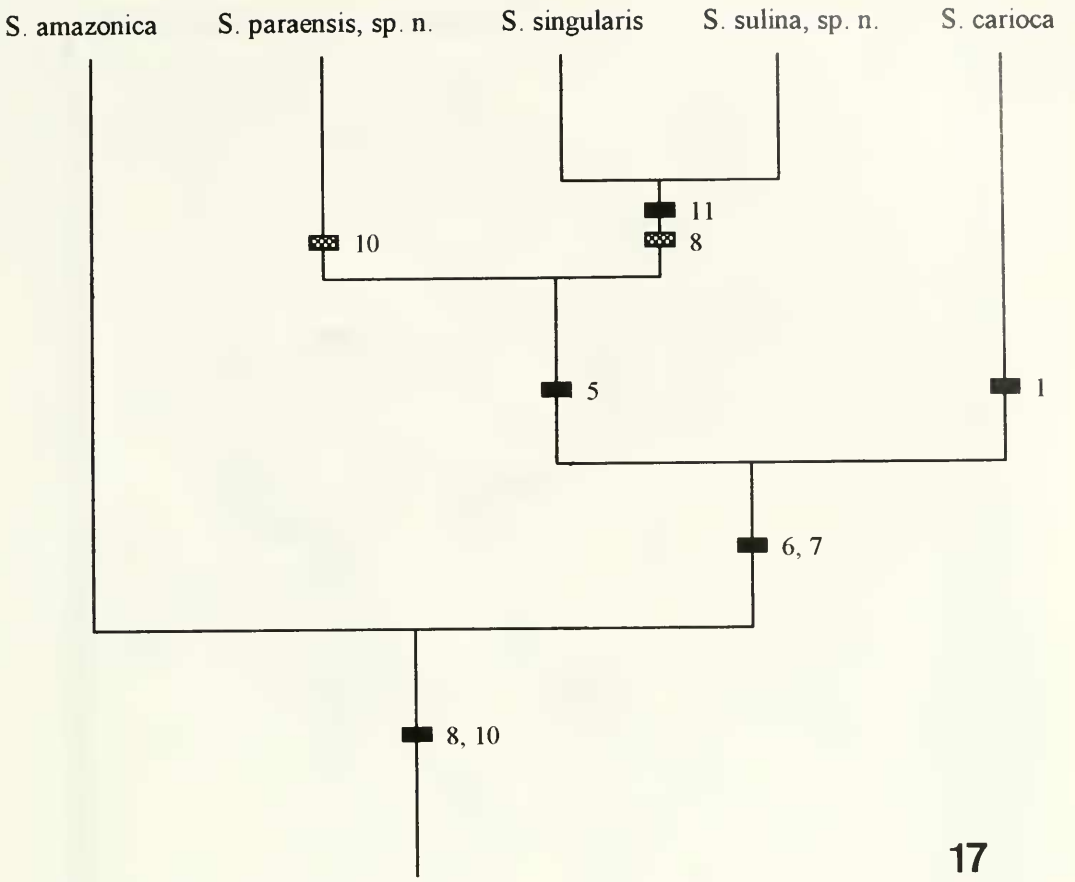


Fig. 17. Cladogram of species of *Souzalopesmyia*. Synapomorphies = solid black rectangles; reversal = dotted rectangles. Character numbers correspond to those stated in Table 1.

lho, 1993; *Helina, Phaonia* and *Souzalopesmyia*.

Souzalopesmyia is a small and isolated clade, apparently representing an ancient lineage of Phaoniinae. The species of genus have head elongate which is commonly correlated with broad male frons (Vockeroth 1972). But these lengthening is considered independent from that in the some genera in the subfamilies Atherigoninae, Cyrtoneurininae, Azeliinae-Reinwardtiini or Mydaeinae.

The Hennig86 phylogenetic analysis of *Souzalopesmyia* was based on seven characters (with an asterisk in Table 1) and resulted in a single tree shown in Fig. 17 (length = 9 steps, consistency index = 0.77, retention index = 0.75).

Biogeography

Hennig (1965) argued that the first invasion (Edentata level) of the Neotropical Muscidae fauna may have come from the Northern Hemisphere during the Upper Cretaceous or Early Tertiary period. This time frame was also suggested by Michelsen (1991) for the invasion of the basal clade of the Anthomyiidae, *Coenosopsia* + *Phaonantho*, into South America.

There are few papers on biogeography of Muscidae, none of them of Neotropical Region, except Hennig (1965). In Holarctic Region, all taxa of the *Eudasyphora* s. str. Townsend (Muscinae) are faunal elements of known dispersal centers (Cuny 1980). The speciation of these flies, were correlat-

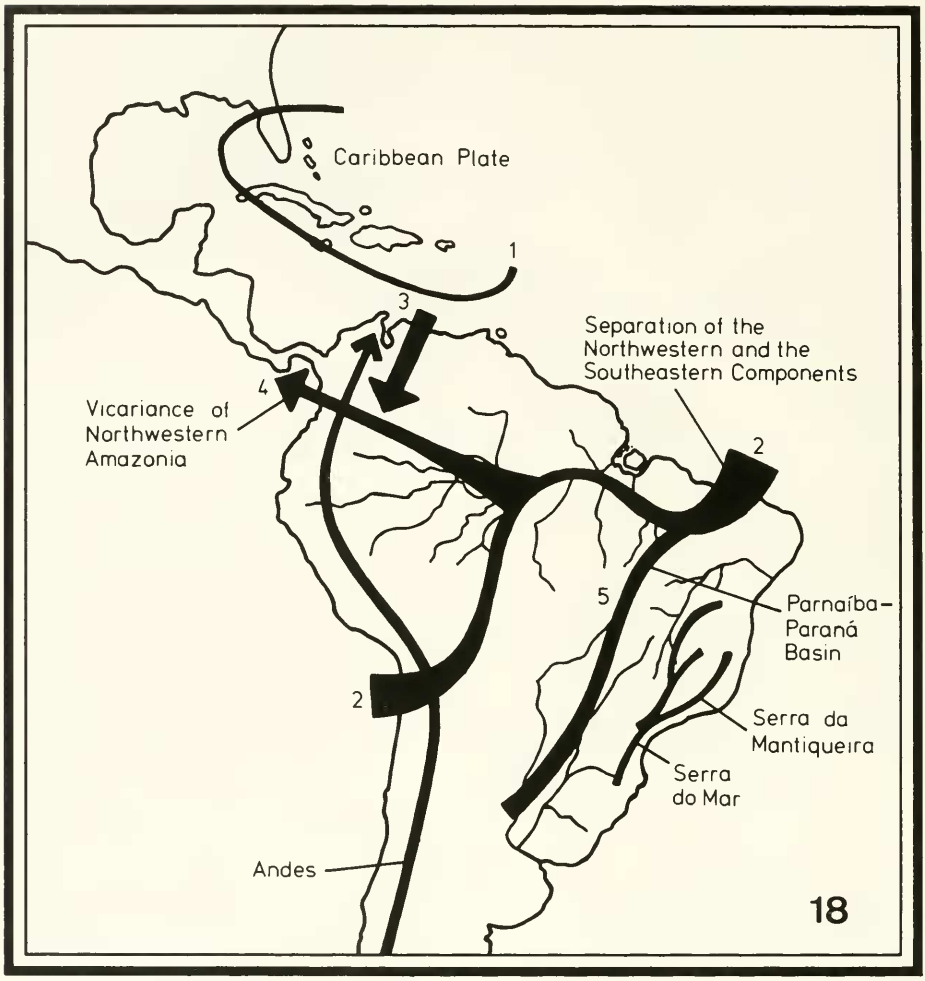


Fig. 18. A summary of the main vicariance barriers in the history of the Neotropical region. I = Carribbean Plate detachment from the mainland. 2 = Separation between the Northwestern and the Southeastern main components, a line along the Rivers Amazonas/Madeira/Mamoré in the Amazonian Basin. 3 = Epicontinental sea formation in the Maracaibo area. 4 = A large division in northwestern Amazonia (not related to date to any geological event). 5 = Middle to Late Cretaceous water connection between the Parnaíba Basin and the Paraná Basin (redrawn from Amorim and Pires 1996).

ed with the history of the forest vegetation during the Pleistocene (Cuny 1980).

Amorim and Pires (1996), corroborated independently by Grazia (1997), indicated that the first division in the continental region of the Neotropics was in the Late Cretaceous, showing a northwestern track against a southeastern track (Fig. 18). Alike pattern is showed by Camargo (1996) for some bees (Meliponini, Apinae, Apidae) in Neotropical Region. However, this latter biogeographical reconstruction was postulated by modification occurred by the changing forests in the Pleistocene.

Souzalopesmyia, based on the position of *S. amazonica* as the basal clade of genus, may have had its ancestor back in the Late Cretaceous (Fig. 19). This age for the genus is not unrealistic although no fossil record is known for family older than the Eocene (Evenhuis 1994). Pont and Carvalho (1997) studied three fossil species of Muscidae

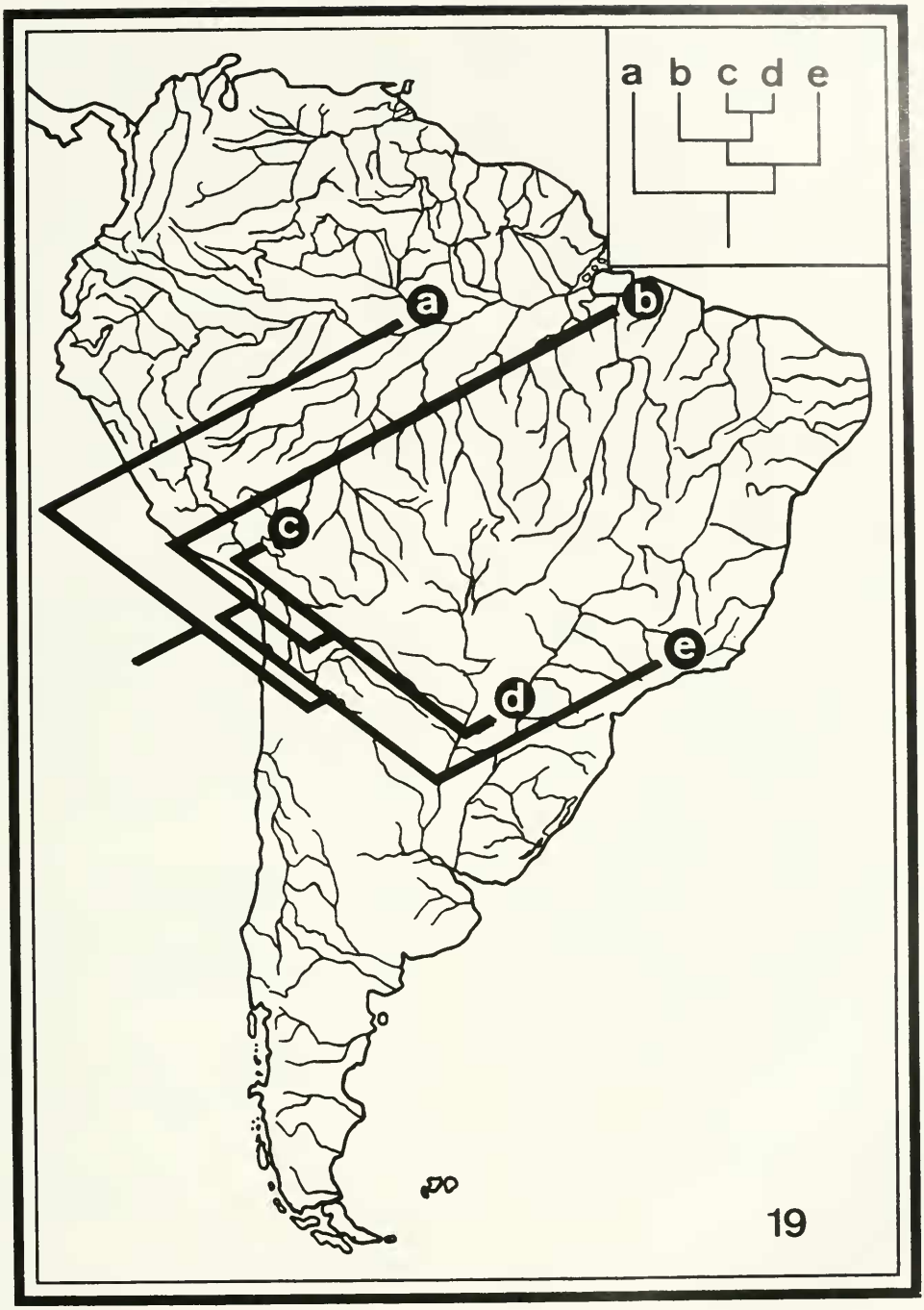


Fig. 19. Geographical distribution of species of *Souzalopesmyia*, with cladogram superimposed. a, *S. amazonica*. b, *S. paraensis*. c, *S. singularis*. d. *S. sulina*. e, *S. carioca*.

from Dominican amber dated from Miocene, 15–20 mya ago, two of which are *Phaonia* species. A cladogram by S. M. P. Coelho (unpublished Ph.D. thesis) suggests that the *Phaonia* fossil species have a more recent origin than the ancestor of *Souzalopesmyia*. The origin of the genus is therefore probably older than 15–20 mya, suggesting that *Souzalopesmyia* is one of the most basal genera of Phaoniinae in the Neotropics.

The origin of the Neotropical Phaoniinae fauna cannot be completely understood on the basis of the present paper. The ancestor of *Souzalopesmyia* may have reached South America by dispersal from North America (Hennig 1965), Africa or have evolved in the Neotropics. The discovery of the sister group of the genus is required.

The five species of *Souzalopesmyia* are morphologically similar and exhibit allopatric distribution suggesting that the terminal branches of this clade could be resulted from relatively recent speciation.

Nevertheless, the allopatric pattern of speciation of the genus cannot be fully explained with the available geological and biogeographical information. Most of the species are known from only a few specimens, suggesting that intensive effort may be necessary before reliable statements can be made about the distribution patterns of the species. Species of *Souzalopesmyia* are not expect to occur in western side of Andes as it requires tropical rainforest (Figs. 18, 19).

The occurrence of *S. paraensis* in Belém, along south side of the Amazon River, part of the northwestern track, could be the result of a single dispersal event (Figs. 18, 19) to colonize that region, in a more recent time, which belongs to the northwestern track.

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